Phys 410 – Homework #1

All problems from Taylor.

1) 1.5 (3 pts)
2) 1.8 (a and b) (6 pts)
3) 1.18 (a and b) (6 pts).
   a) You need not prove all three equalities for each part, just prove one from part (a) and one from part (b) (the others are the same).
   b) For part (a), you may use the fact that the area of a triangle is ½(base)(height), and that the magnitude of a cross product is $|\mathbf{a}||\mathbf{b}|\sin\theta_{ab}$, where θ_{ab} is the angle between vectors **a** and **b**.
4) 1.36 (a, b and c) (9 pts).
5) 1.39 (9 pts).
   a) Hint: the θ_{max} at which the range is maximized is $(\pi/4 - \phi/2)$.
   b) 3 points for proving Taylor's expression for the range, 3 points for proving my expression for θ_{max}, and 3 points for simplifying the expression for R_{max} to the result as given by Taylor.
6) 1.51 (numerical problem) (6 pts).
   a) You may use any software package you prefer, including excel.
   b) Whatever software you use, *make sure that the important constants for the problem are specified in one and only one location*, so that you can change them easily. For this problem, some important constants are, for example, g, R, the initial angle, the initial angular velocity, and the time step (Δt).
   c) Print out and turn in the first page of your code, along with the requested plots.
7) 2.5 (3 pts).
   a) You do not need to solve any equations for this question, because the solution is given in section 2.2 of the text. Instead you should describe the behavior and draw a simple sketch of the velocity as a function of time.
8) 2.8 (3 pts)
9) 2.11 (a, b, and c) (9 pts).
10) 2.19 (a and b) (6 pts)
11) 2.43 (numerical) (a and b) (6 pts for (a), 3 pts for (b), 9 pts total)
12) 2.38 (a, b, and c) (9 pts)
    - It's easiest to let (+y) point up, so that v_0 is a positive number.
    - Start with equation 2.52, except let gravity be negative. Then separate variables and integrate to find v(t).